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NAI Affiliate Partnership Proposal

Sociedad Mexicana de Astrobiología (Mexican Society of Astrobiology, SOMA)

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NAI Affiliate Partnership Proposal

AUTHORS
Antígona Segura, Instituto de Ciencias Nucleares, UNAM, Mexico
Irma Lozada-Chávez, University of Leipzig, Germany
Sandra I. Ramírez Jiménez, Centro de Investigaciones Químicas, UAEM, Mexico

CONTRIBUTORS
Hugo Beraldi-Campesi, Instituto de Geología, UNAM
Thomas Buhse, Centro de Investigaciones Químicas, UAEM
Elizabeth Chacón-Baca, Facultad de Ciencias de la Tierra, UANL
Luis Delaye Arredondo, CINVESTAV, Irapuato
Carlos del Burgo, Instituto Nacional de Óptica, Electrónica y Astrofísica, INAOE
Eduardo de la Fuente-Acosta, Universidad de Guadalajara
Elva Escobar-Briones, Instituto de Ciencias del Mar y Limnología, UNAM
Laura Luna, Instituto de Geología, UNAM
Dolores Maravilla-Meza, Instituto de Geofísica, UNAM
Fernando Ortega-Gutiérrez, Instituto de Geología, UNAM
Valeria F. Souza Saldívar, Instituto de Ecología, UNAM
Pedro Valdés-Sada, Universidad de Monterrey
Roberto Vázquez-Meza, Instituto de Astronomía, Ensenada, UNAM

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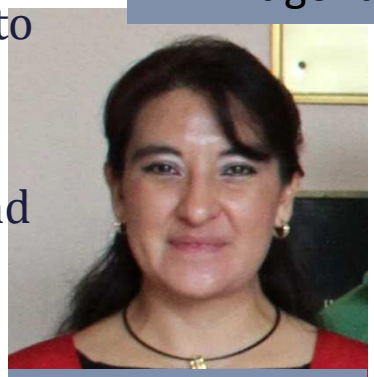
Proposal for becoming a NAI International Affiliate

- Our proposal focuses on collaborating with the NASA Astrobiology Institute (NAI) on three main objectives:
  - **Research:** Establishing collaborative links between the Mexican scientific community – either currently working on or interested in initiating research on astrobiology – and the NAI community.
  - **Formation of Human Resources:** Supporting the participation of early-career scientists and graduate students in SOMA and NAI activities, as well as promoting their interaction with the astrobiology international community.
  - **Education and Public Outreach:** Creating and promoting tools and activities for disseminating knowledge about Astrobiology to the general public, including high school and undergraduate students.

The Mexican Society of Astrobiology

- SOMA is a non-profit, self-sustaining organization consisting of a multidisciplinary group of academics and students interested in promoting the knowledge and progress of Astrobiology in Mexico.
- Its headquarters are located at Instituto de Ciencias Nucleares (ICN) at the Universidad Nacional Autónoma de México (UNAM) in Mexico City.
- SOMA is presently directed by:
  - Dr. Antígona Segura, President, an astronomer dedicated to the study of exoplanets and biosignatures.
  - Dr. Sandra I. Ramírez-Jiménez, Vice-president, a chemist that is an expert in the study of planetary atmospheres and extremophiles.

Antígona



Sandra

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Activities

A1. SOMA scientific meetings

Seven SOMA scientific meetings since 2001:
- Invited, oral and poster presentations from researchers, undergraduate and graduate students.
- 80 attendees on average per meeting.
- Next one in August 24th, 2012 in Cuernavaca, Morelos.
- VIII SOMA meeting web site http://soma.nucleares.unam.mx/

The picture below was taken from the SOMA meeting 2007. Universum Science Museum, UNAM. Mexico City

A2. SOMA at international scientific meetings

2008 - International Society for the Study of the Origin of Life and Astrobiology Society (ISSOL) 2008
- European Astrobiology Network Association (EANA)

2009 - National Physics Conference

2011 - Origins: The International Astrobiology Society and Bioastronomy (IAU C51) Joint International Conference
- European Astrobiology Network Association (EANA)

2012 - Astrobiology Science Conference (AbSciCon)

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VIII Meeting of SOMA
August 24, 2012

- 120 participants from 13 of 32 states.
- 2 invited talks, 10 oral contributions, 24 poster contributions.
- Mostly students (undergraduate, graduate and posdoctoral).

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Activities for undergraduate and graduate students

A3. Undergraduate and graduate courses

- 2008 to date: **Selected topics in Astronomy: Astrobiology.** Facultad de Ciencias, Universidad Nacional Autónoma de México (UNAM). http://sites.google.com/site/cursoastrobio/

- 2004 to date: **Introduction to astrobiology.** Facultad de Ciencias, Universidad Autónoma de Baja California. http://sites.google.com/site/astrobio101/

- Curricula for the elective courses Astrobiology I and II for the Graduate Program of Astrophysics, UNAM: http://www.astroscu.unam.mx/posgrado/Posgrado-Astrofisica/Programa-Astrofisica2011.pdf

- 2011-212: Advice and proposal of the curriculum for the **new program** dedicated to **Space Sciences,** Universidad de Baja California.

A4. SOMA schools and workshops

Workshop for High School teachers

- 60 hrs. August 22th to November 28th, 2009
- 30 hrs. June 21th – 25th, 2010

Biannual Mexican School of Astrobiology

- 25 attendees
- 30 hrs. June 13th – 15th, 2011

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Invited international researchers

A7. Invited international researches

2001: François Raulin and Patrice Coll (Université Paris XII)
Invited speaker for the I Meeting of SOMA (August 28-31, 2001)

2002: Vladimir Alexandrov (Moscow State University)
Invited speaker for the II Meeting of SOMA (August 29-30, 2002)

2004: Frédéric Masset (Service d'Astrophysique, Saclay, France)
Invited speaker for the III Meeting of SOMA (June 23-25, 2004)

2007: Frank Drake (SETI Institute)
Invited speaker for the IV Meeting of SOMA (April 19-20, 2007)
Lecture "How many habitable plants are there?" at the Instituto de Ciencias Nucleares UNAM (April 17, 2007)
Jesús Martínez Frías (Centro de Astrobiología, Spain)
Lecture "Planetary geology and Mars exploration: The relevance of Mars analog sites" at the Instituto de Ciencias Nucleares UNAM (September 27, 2007)

2009: Margarita Marinova (California Institute of Technology), Fred A. Rainey (Lousiana State University), Chris McKay (NASA Ames Research Center)
Series of Lectures: Mars Colonization at the Instituto de Ciencias Nucleares, UNAM (March 13, 2009)

2010: Lisa Kaltenegger (Max Planck Institute for Astronomy/Harvard-Smithsonian)
Visiting professor at the Instituto de Ciencias Nucleares, UNAM (March 7-22, 2010)
Lectures at the Instituto de Geofísica and Instituto de Ciencias Nucleares, UNAM
Invited speaker for the VII Meeting of SOMA (August 18-19, 2010)

2011: Victoria Meadows (Virtual Planetary Laboratory at UW)
Visiting professor at the Instituto de Ciencias Nucleares, UNAM (June 9-15, 2011)
Invited speaker for the I Mexican School of Astrobiology (June 13-15, 2011)
Lectures at the Instituto de Astronomía and Instituto de Ciencias Nucleares, UNAM.
Sean Raymond (Laboratoire d'Astrophysique de Bordeaux, France), Michael Meyer (NASA)
Invited speakers (videoconference) for the Day of Astrobiology (December 2, 2011)

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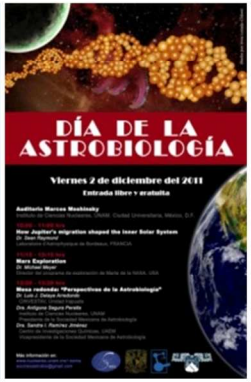
Academic activities

A5. Open academic activities



- **Bimonthly electronic bulletin** (only for members and international fellows): Year 4, Issue 35. Editor: Irma Lozada-Chávez
  http://www.nucleares.unam.mx/soma/index.php/boletin

- **Lectures** (for researchers, undergraduate and graduate students):
  "Planetary geology and Mars exploration: relevance of Earth's analogs" (September 27th, 2007)
  Jesús Martínez Frías, CAB, Spain
  "About stars, planets, life and other curiosities" (March-August, 2009)
  6 lectures by scientists working in Mexico
  "Colonization of Mars" (March 1st, 2009)
  5 lectures, 2 by Mexican researchers and 3 by US researchers
  "Geophysics and biology of hydrothermal vents" (May 23th, 2011)
  3 lectures by Mexican female researchers
  "The VPL and the search for habitable planets" (June 13th, 2011)
  Victoria Meadows, VPL-NAI, US

- **The day of Astrobiology** (December 2nd, 2011)
  2 remote lectures by Sean Raymond and Michael Meyer, one discussion panel by Mexican researchers

- **The week of Astrobiology** (April 9 -13, 2012)
  Organized by students with the Nibiru Astronomical Society

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Public outreach

A6. Public outreach activities

Movies and science:

- Cosmic Collisions (November 15th, 2007)
- Aliens of the deep (March 27th, 2008)

Public Lectures and demonstrations:

- Discussion panel: ***Extraterrestrial life and Science Fiction*** (May 6th, 2008)
- Astrobiology and Solar System exhibit in the ***Astronomy Fair*** in downtown Mexico City (November 20-29, 2009)
- Stand dedicated to Astrobiology in the ***Space Week*** (October 9th, 2010)
- Stand dedicated to Astrobiology in ***The Night of the Stars*** (April 17th, 2010 and February 26th, 2011)
- ***Science on the Streets*** dedicated to Astrobiology, downtown Mexico City (December 3rd, 2011) organized in collaboration with Mexico City's Government (more than 2,000 attendees)
- Lectures for incarcerated minors (February, 2012)

A10. SOMA online sources

- **SOMA web site** (in Spanish and some contents in English): **http://www.nucleares.unam.mx/soma/**
- **Facebook:** http://facebook.com/astrobiologiamexico
- **Astrobiology "yellow pages"** (Mexico and Colombia): http://sites.google.com/site/directorioastrobiologia/
- **Workshop website:** http://sites.google.com/site/tallerdeastrobiologia/
- **Mail-list for astrobiology related announcements (for non-SOMA members):** http://mx.groups.yahoo.com/group/soc_mex_astrobiologia/
- **Astrobiology resources for teachers (work in progress):** http://www.nucleares.unam.mx/astrobiologia/

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Collaborations

A8. SOMA national collaborations

- **Universidad Nacional Autónoma de México (UNAM):**
  Instituto de Ciencias Nucleares, Instituto de Ciencias del Mar y Limnología, Instituto de Astronomía, Instituto de Geofísica, Facultad de Ciencias, Museo de Geología, Dirección General de Divulgación de la Ciencia, Posgrado en Ciencias de la Tierra, Posgrado en Astronomía
- **Universidad Autónoma Metropolitana (UAM)**, Unidad Cuajimalpa
- **Universidad Autónoma del Estado de Morelos (UAEM):** Centro de Investigaciones Químicas (CIQ)
- **Universidad Autónoma de Baja California (UABC):** Facultad de Ciencias
- **Instituto Potosino de Investigación Científica y Tecnológica A.C.** (IPICYT)
- **Instituto de Ciencia y Tecnología del Distrito Federal** (ICYTDF)
- ***Nibiru:*** Sociedad Astronómica de la Facultad de Ciencias, UNAM
- ***SAFIR:*** Sociedad Astronómica de la Facultad de Ingeniería, UNAM
- ***SAM:*** Sociedad Astronómica de México
- ***GAK:*** Grupo Astronómico Kepler

A9. SOMA international affiliations

2011: European Astrobiology Network Association (EANA)

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Astrobiology research in Mexico by SOMA members

Research in ASTROBIOLOGY	Goal of the NASA Astrobiology Roadmap	Researcher (Affiliation)
- Microbial biosignatures, - Morpho-biological development of microbialites. - Extremophiles from subaerial hydrothermal deposits. - Early life on land. - Biological Soil Crusts.	3, 4, 5, 7	**Dr. Hugo Beraldi Campesi** (Instituto de Geología, UNAM)
- Role of minerals in chemical evolution. - Stability of organic molecules in extreme conditions.	2	**Dr. María Colín García** (Instituto de Geología, UNAM)
- Origin and evolution of genetic regulation. - Evolution of energy supply *via* metabolic pathways in extreme organisms. - Evolution of complex multicellular organisms. - Origin and evolution of viruses and the RNA world.	3, 5, 6	**M. Sc. Irma Lozada Chávez** (University of Leipzig, Germany)
- Diversity and mechanisms of adaptation of anaerobic microorganisms in hypersaline environments. - Carbon biogeochemical cycles under extreme and anaerobic conditions.	4, 5	**Dr. Lilia Montoya Lorenzana** (Centro de Investigaciones Químicas, UAEM)
- Chemistry of planetary atmospheres. - Mars analog sites and life detection on Mars. - Life in extreme environments.	2, 4, 6, 7	**Dr. Rafael Navarro González** (Instituto de Ciencias Nucleares, UNAM)
- Physical and chemical properties of Titan's aerosols. - Extremophiles in the context of Europa's ocean.	2, 5	**Dr. Sandra I. Ramírez Jiménez** (Centro de Investigaciones Químicas, UAEM)
- Planetary habitability. - Remote detection of life. - Biosignatures.	1, 4, 7	**Dr. Antígona Segura Peralta** (Instituto de Ciencias Nucleares, UNAM)

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Astrobiology research in Mexico by SOMA members

Research in ASTRONOMY	Goal of the NASA Astrobiology Roadmap	Researcher (Affiliation)
- Galactic habitable zones.	1	**Dr. Leticia Carigi Delgado** (Instituto de Astronomía, UNAM)
- Interstellar medium, high energy particles and their interaction with planetary atmospheres.	1, 4	**Dr. Eduardo de la Fuente Acosta** (Universidad de Guadalajara)
- Dynamics of planetary systems in different galactic environments.	1	**Dr. Bárbara Pichardo Silva** (Instituto de Astronomía, UNAM)
- Solar System minor bodies, dynamics of planetary systems.	1	**Dr. Arcadio Poveda Ricalde** (Instituto de Astronomía, UNAM)
- Exoplanet characterization. - Astrometry and photometry of asteroids & comets. - High-Resolution Mid-Infrared Spectroscopy of Hydrocarbons in Jovian Atmospheres.	1	**Dr. Pedro Valdés Sada** (Universidad de Monterrey)
- Interstellar medium: planetary nebulae. - Small Solar System bodies. - Inverse panspermia.	1, 4, 5, 6	**Dr. Roberto Vázquez Meza** (Instituto de Astronomía, Ensenada, UNAM)

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Astrobiology research in Mexico by SOMA members

Research in CHEMISTRY AND BIOLOGY	Goal of the NASA Astrobiology Roadmap	Researcher (Affiliation)
- Origins of biomolecular homochirality and auto-replicant systems. - Rupture of chiral symmetry in crystallization. - Kinetic simulations of auto-catalytic systems. - Simulations of the prebiotic peptides formation.	3	**Dr. Thomas Buhse** (Centro de Investigaciones Químicas, UAEM)
- Iron and sulfur-based biospheres and their biosignatures. - Hydrogeology and microbiology at active springs.	1, 2, 5, 6, 7	**Dr. Javiera Cervini Silva** (Universidad Autónoma Metropolitana, Unidad Cuajimalpa)
- Geobiology of microbialites. - Microbial signatures (microbial carbonates or biogeological signatures).	3, 5	**Dr. Elizabeth Chacón Baca** (Facultad de Ciencias, UANL)
- Evolution of minimal gene sets.	5	**Dr. Luis Delaye Arredondo** (CINVESTAV, Irapuato)
- Ecological evolution of Bacteria.	3, 4, 5	**Dr. Luis Enrique Eguiarte Fruns** (Instituto de Ecología, UNAM)
- Biological implications of inverse panspermia.	4, 5, 6	**Dr. Patricia G. Núñez Pérez** (Instituto de Estudios Avanzados de Baja California)
- Microbiology of hydrothermal vents and anoxic submarine environments.	5, 6	**Dr. Elva Escobar Briones** (Instituto de Ciencias del Mar y Limnología, UNAM)
- Aquatic microbial biodiversity in Cuatro Ciénegas, Coahuila México. - Relevance of the horizontal gene transfer in the context of the origin of life.	3, 4, 5	**Dr. Valeria F. Souza Saldivar** (Instituto de Ecología, UNAM)

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Astrobiology research in Mexico by SOMA members

Research in GEOPHYSICS & PLANETARY SCIENCES	Goal of the NASA Astrobiology Roadmap	Researcher (Affiliation)
- Microscopic characterization of sinter deposits. - Spectroscopy and mineral characterization of surface hydrothermal alteration zones.	2, 7	**Dr. Carles Canet Miquel** (Instituto de Geofísica, UNAM)
- Petrological properties of chondrites.	1, 2	**Dr. Karina Cervantes de la Cruz** (Centro de Geociencias, UNAM)
- Impact cratering and meteors.	1, 2	**Dr. Guadalupe Cordero Tercero** (Instituto de Geofísica, UNAM)
- Stellar habitable zones. - Mars geology.	1, 2	**Dr. Héctor Durand Manterola** (Instituto de Geología, UNAM)
- Rings of Saturn, dusty plasmas.	2	**Dr. Dolores Maravilla Meza** (Instituto de Geofísica, UNAM)
- Geology of the early Earth and Mars. - Origin of Life. - Mars analogs on Earth.	2, 3	**Dr. Fernando Ortega Gutiérrez** (Instituto de Geología, UNAM)

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Astrobiology projects with funding

- Mexican universities and the Mexican Council of Science and Technology (CONACyT) are currently funding Astrobiology related projects.
- At least 27 projects have been funded since 2003.

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Collaborations with NAI

Dr. Hugo Beraldi-Campesi (Instuto de Geología, UNAM)

Dr. Jack D Farmer, Arizona State University (ASU) NAI team (CAN 5)

Dr. Ferrán García-Pichel, Dr. Ariel D Anbar, and Dr. Hilairy Hartnett.

Currently collaborates with Dr. Farmer and Dr. García-Pichel.

Dr. Elizabeth Chacón-Baca (Universidad Autónoma de Nuevo León)

Dr. Andrew Knoll, Principal Investigator of the Harvard University NAI team (CAN1) and a member of the Carnegie Institution of Washington NAI team (CAN 1), the NASA JPL NAI team (CAN 1), and the MIT NAI team (CAN 4).

Dr. Ferrán Gacía-Pichel, ASU NAI team (CAN 1, CAN 5), NASA Ames Research Center NAI team (CAN 1), and the University of Washington NAI team (CAN 2)

Dr. María Colín-García (Instituto de Geología, UNAM)

Dr. Ricardo Amils, Marine Biological Laboratory NAI team (CAN 1, CAN 3) and of the NASA Ames Research NAI team (CAN 3)

Dr. David Fernández-Remolar, Harvard University NAI team (CAN 1).

Dr. Javiera Cervini-Silva (Universidad Autónoma Metropolitana, Cuajimalpa)

Member of the University of California, Berkeley (UC-B) NAI team (CAN 3) and is a Co-Investigator on *BioMARS*, *Iron and Sulfur-Based Biospheres and Their Biosignatures,* and *Relationship Between Hydrogeology and Microbiology at Active Springs.*

Currently collaborates with Dr. Jill Banfield.

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Collaborations with NAI

Dr. Lilia Montoya-Lorenzana (Centro de Investigaciones Químicas, UAEM)

Dr. Ricardo Amils, Centro de Astrobiología, Spain (NAI International Affiliate), of the Marine Biological Laboratory NAI team (CAN 1, CAN 3), and of the NASA Ames Research NAI team (CAN 3).

Dr. Fernando Ortega (Instituto de Geología, UNAM)

Dr. Chistopher McKay, NASA Ames Research Center NAI team (CAN 1, CAN 3), the University of Washington NAI team (CAN 2), and the University of Hawaii, Manoa NAI team (CAN 3, CAN 5).

Dr. Rafael Navarro-González (Instituto de Ciencias Nucleares, UNAM)

Dr. Christopher McKay, NASA Ames Research Center NAI team (CAN 1, CAN 3), the University of Washington NAI team (CAN 2), and the University of Hawaii, Manoa NAI team (CAN 3, CAN 5).

Dr. Navarro is part of the Sample Analysis at Mars (SAM) Investigation and Instrument Suite team.

Dr. Luis Eguiarte (Instituto de Ecología, UNAM)

Member of the Arizona State University (ASU) NAI team (CAN 1) and the Virtual Planetary (VPL) NAI team (CAN 4).

Dr. Antígona Segura (Instituto de Ciencias Nucleares, UNAM)

Member of the Virtual Planetary Laboratory (VPL) NAI team (CAN 2, CAN 4)

Currently she is collaborator of the CAN 6 VPL (accepted) proposal.

Dr. Valeria Souza (Instituto de Ecología, UNAM)

Arizona State University NAI team (CAN 1, CAN 5), and the NAI's Virtual Planetary Laboratory (CAN 4)

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Near term activities: Research

- Creating and hosting a public database written in English at the SOMA Website, which will include an updated description of the Astrobiology-related research done in Mexican institutions.
- Including information in the database specific to field sites for Astrobiology research in Mexico.

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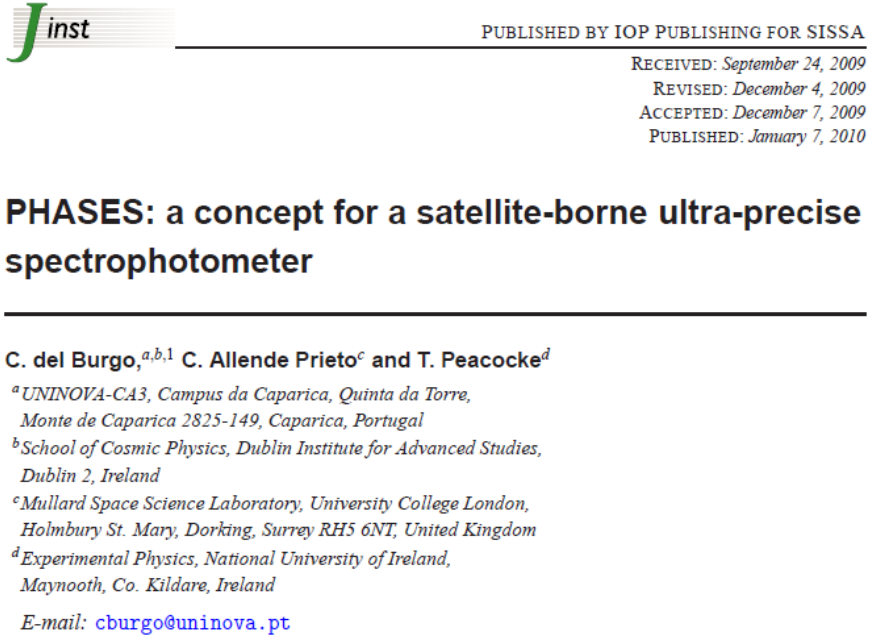
Near term activities: Research

- Establishing specific collaborations for the PHASES mission, related to exoplanet detection and characterization.

PHASES: microsatellite launched into Sun-synchronous low Earth orbit. Ultraprecise absolute spectrophotometry in the wavelength range 370-960 nm with a resolving power that varies from 900 (at 370 nm) to 200 (at 960 nm). Possible applications of PHASES are: 1) obtaining spectral catalogs of bright stars absolutely calibrated in flux, 2) the better characterization of known transiting planetary systems (including a fortuitous discovery of large moons), and 3) astroseismology.



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PHASES: a concept for a satellite-borne ultra-precise spectrophotometer

C. del Burgo,[a,b,1] C. Allende Prieto[c] and T. Peacocke[d]

[a] *UNINOVA-CA3, Campus da Caparica, Quinta da Torre, Monte de Caparica 2825-149, Caparica, Portugal*
[b] *School of Cosmic Physics, Dublin Institute for Advanced Studies, Dublin 2, Ireland*
[c] *Mullard Space Science Laboratory, University College London, Holmbury St. Mary, Dorking, Surrey RH5 6NT, United Kingdom*
[d] *Experimental Physics, National University of Ireland, Maynooth, Co. Kildare, Ireland*

E-mail: cburgo@uninova.pt

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Near term activities: Formation of human resources

- Organization of the Biannual Mexican School of Astrobiology including at least one lecture, class or short course imparted, either physically or through videoconference, by an NAI scientist.
- Co-organization of the Latin American School of Astrobiology in collaboration with Centro de Astrobiología (Spain), Instituto de Astrobiología (Colombia), and University of São Paulo Research Unit in Astrobiology (Brazil).
- Co-organization of monthly Astrobiology seminars (in Spanish) in collaboration with Centro de Astrobiología (Spain), Instituto de Astrobiología (Colombia), and the University of São Paulo Research Unit in Astrobiology (Brazil). The seminars can be broadcasted using Adobe Connect or a videoconference system.
- Obtaining funding from the National Council of Science and Technology (Consejo Nacional de Ciencia y Tecnología, CONACyT Mexico) to support students to attend international schools of Astrobiology and Astrobiology meetings organized by the NAI and other institutions or scientific associations.
- Promoting among Mexican institutions the use of tools already available from the NASA Astrobiology Program through conferences and the SOMA website in order to encourage students and researchers interested in pursuing a career in Astrobiology.

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Near term activities: Education and Public Outreach

- Provide to NAI:
  - Posters content was created by scientists already involved in Astrobiology and they were designed to be attractive for the general public.
  - Booklets were created by the Communication of Science Unit at the Instituto de Ciencias Nucleares, UNAM, in collaboration with the expert on the subject of each booklet.
- Create new posters and booklets in Spanish focused on communicating the advances Astrobiology research carried out by researchers in Mexican institutions and NAI scientists.

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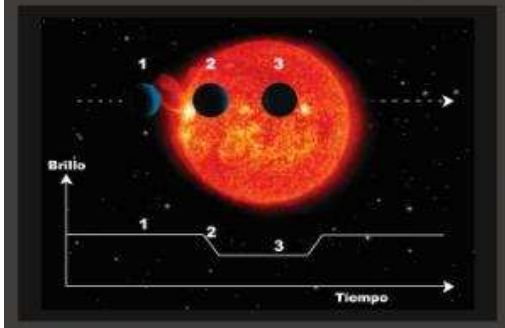
Posters

Mundos alrededor de otras estrellas

¿Cómo los encontramos?

Cuando un planeta gira alrededor de una estrella, ésta se bambolea como lo hace un trompo mientras gira. Desde la Tierra lo que observamos es que la estrella se acerca y se aleja ligeramente. En el espectro de la estrella, su luz se desplaza hacia el rojo cuando se aleja y hacia el azul cuando se acerca, lo que nos indica la presencia de un planeta.

Cuando un planeta pasa frente a su estrella, la luz estelar disminuye en una fracción mínima. Midiendo esta disminución en el brillo estelar se pueden detectar exoplanetas.



En 1995 descubrimos el primer planeta girando alrededor de una estrella similar al Sol. A la fecha hemos detectado más de 400 planetas alrededor de otras estrellas. A estos mundos les llamamos planetas extrasolares o exoplanetas pues se encuentran fuera de nuestro Sistema Solar.

¿En qué galaxia están?

Nuestra galaxia posee un disco que mide cien mil años luz (la luz tarda cien mil años en ir de un extremo a otro). Los planetas más lejanos que podemos detectar giran alrededor de estrellas que están a unos mil años luz de distancia de nosotros, es decir, en nuestra galaxia.

¿Cómo son?

El 60% de los exoplanetas tienen masas similares o mayores a la de Júpiter, 34% son como Urano o Neptuno y solo el 5% de los exoplanetas tienen masas entre 2 y 10 veces la masa de la Tierra. Detectar planetas más pequeños requiere nuevas tecnologías, como la del telescopio espacial Kepler.

Sociedad Mexicana de Astrobiología
http://www.nucleares.unam.mx/~soma/

Elaborado por Antígona Segura e Irma Lozada-Chávez
Apoyo proyecto PAPIME PE105609

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Posters

Subject	Material	Content description	Authors
Astrobiology	Poster	Relation of astrobiology with other sciences: mathematics, biology, astrophysics, engineering, geophysics and chemistry.	M. Sc. Irma Lozada-Chávez
Extremophiles and extreme environments *(example in Fig. 1-right)*	Poster	What is an extremophile, where they live and why they are important to astrobiology	Dr. Sandra Ramírez-Jiménez and M. Sc. Irma Lozada-Chávez
Life in the Solar System	Poster	Description of Mars, Titan (Saturn's satellite) and Europa (Jupiter's satellite)	Dr. Antígona Segura and M. Sc. Irma Lozada Chávez
Mars, a second Earth?	Poster	Mars terraforming	Dr. Antígona Segura and M. Sc. Irma Lozada Chávez
Exoplanets *(example in Fig. 1-left)*	Poster	Definition, detection techniques and exoplanets properties	Dr. Antígona Segura and M. Sc. Irma Lozada Chávez
Habitable worlds	Poster	Definition and characterization of habitable planets	Dr. Antígona Segura and M. Sc. Irma Lozada Chávez
Stardust: Stellar origins of living beings	Poster	Chemical evolution of the Universe	Dr. Leticia Carigi and M. Sc. Fátima Robles-Valdez
Life as we know it: carbon and water	Poster	Carbon and water in molecular clouds and protoplanetary disks	M. Sc. José Rodrigo Sacahui-Reyes and Dr. Antígona Segura
Habitable planets	Booklet	Exoplanet detection and characterization of habitable planets	Dr. Antígona Segura and Gabriela Frías
Mars terraformation	Booklet	The process of terraforming Mars	Dr. Rafael Navarro and Gabriela Frías

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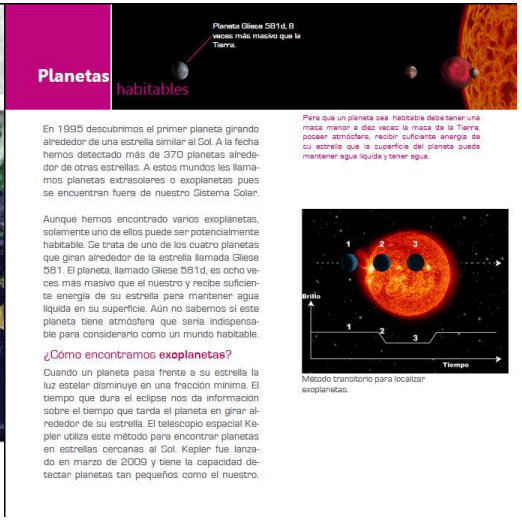
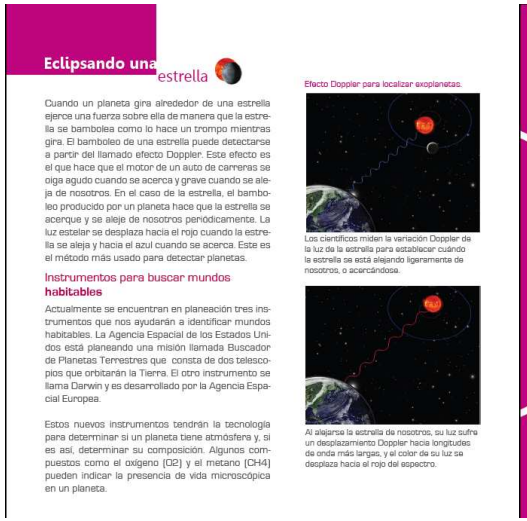
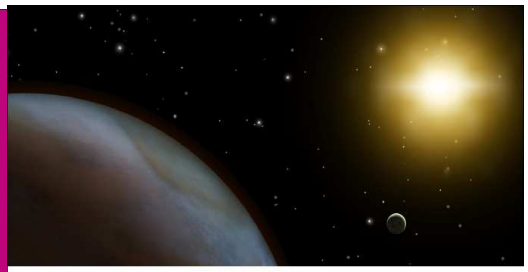
Booklets







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Proyecto PAPIME - PE105809
Un viaje por el Universo
Proyecto PAPIME - PE105809
La Astrobiología en México: oportunidades educativas en disciplinas múltiples
COMUNICACIÓN DE LA CIENCIA
Textos
Antigona Segura
Gabriela Frías
Diseño Gráfico
Hortensia Segura
Imágenes originales
Ulises Gómez, Gabriela Pastén, Antonio Moreno
www.nucleares.unam.mx

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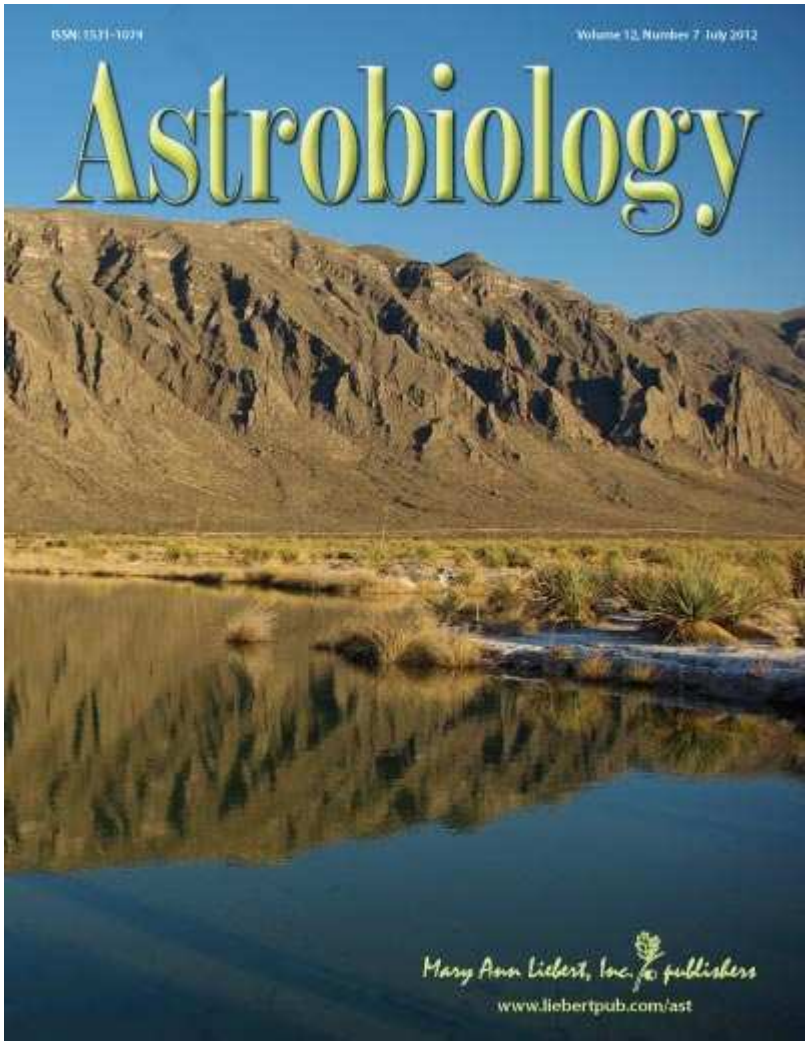
Near term activities: Education and Public Outreach

Generate a bilingual (English and Spanish) script and film material to make virtual visits to places in Mexico that are relevant to Astrobiology, similar to those already existing for Australian sites (http://vft.asu.edu/).

First site: Cuatro Ciénegas, Coahuila, Mexico (see description of the site in Appendix C), with the collaboration of Dr. Valeria Souza (Instituto de Ecología, UNAM) and Dr. Janet Siefert (Rice University, Texas, Virtual Planetary Laboratory NAI team, and the Arizona State University NAI team).



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Near term activities: Education and Public Outreach

- Create a Spanish website for young students (12 to 18 years old) interested in learning about the basic concepts of Astrobiology.
- Participants: cartoonists, professionals in science communication, and scientists actively doing Astrobiology.

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Near term activities: Education and Public Outreach

Chapter	Content	Authors
1. **Introduction**	- Definition of astrobiology - Objectives of Astrobiology - History of Astrobiology	Dr. Sandra I. Ramírez-Jiménez
2. The Universe	- Time scales - Cosmochemistry - Abundance of chemical elements - Nucleosynthesis and recycling of chemical elements - Molecules in the interstellar medium	Dr. Leticia Carigi
3. Planetary systems	- Formation and evolution of protoplanetary disks - Planet formation - Dynamical evolution of planetary systems - The Solar System - Exoplanet detection - Characteristics of exoplanets and planetary systems	Dr. Antígona Segura
4. Earth as a planet	- Earth's atmosphere - Geologic structure and evolution of Earth - Thermal evolution of Earth	Dr. Sandra I. Ramírez-Jiménez, Dr. Guadalupe Cordero
5. Life on Earth and definition of life	- Definition of life: - The seven pillars of life	M. Sc. Irma Lozada-Chávez
6. Origin of life on Earth	- History and theories on the origin of life - Prebiotic synthesis of organic compounds - RNA world and the origin of the protocell - Origin of metabolisms - DNA world and the origin of proteins (genetic code)	M. Sc. Irma Lozada-Chávez

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Near term activities: Education and Public Outreach

Chapter	Content	Authors
7. Biological evolution	- Basic concepts of the theory of evolution - Early evolution of prokaryotes and eukaryotes - Biological extinctions and speciation - Human evolution	M. Sc. Irma Lozada-Chávez, Dr. Lilia Montoya, Dr. Guadalupe Cordero, Dr. Julio Valdivia, Dr. Cruz Lozano
8. Extremophiles and extreme environments	- Biology of extremophiles - Extremophiles and biotechnology - Extremophiles and Astrobiology	Dr. Sandra I. Ramírez-Jiménez, Dr. Lilia Montoya
9. Astrobiology on Mars	- Geologic history - The Viking experiment - ALH84001 meteorite and the search for biomarkers - Mars analogue sites on Earth	Not yet assigned
10. Astrobiology on Solar System satellites	- Titan - Europa - Enceladus - The Moon	Dr. Sandra Ramírez-Jiménez, Dr. Lilia Montoya, Dr. Guadalupe Cordero, and Dr. Elva Escobar-Briones
11. Life in the Universe	- Planetary habitability - Signatures from a habitable world - Drake's Equation - Communication with extraterrestrial civilizations - Galactic Habitable Zone	Dr. Antígona Segura and Dr. Leticia Carigi
12. Evolutionary paradigms in the search for life in the Universe	- Determinism *versus* contingency in the origin and evolution of life - Trends in the evolution of life on Earth - The 'Rare Earth' hypothesis - Evolution of complex multicellular organisms	M. Sc. Irma Lozada-Chávez

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Resources

- Websites: The SOMA website hosted by the Instituto de Ciencias Nucleares, UNAM. The institute provides technical support for the website and has created a server where all the electronic resources created and maintained by SOMA will be hosted in the near future. See appendix A10.
- Human resources: SOMA members (researchers and students) enthusiastically collaborate on research and EPO activities.
- Astrobiology relevant sites: These sites may be accessed by NAI scientists through those researchers in Mexican academic institutions who are already working or interested on studying these sites. SOMA will serve as a link for establishing contact with interested researchers.
- EPO materials: They include posters, booklets, technical information on specific topics, proceedings from SOMA Meetings, etc.
- Resources for academic activities: Most of the SOMA members are incorporated into an academic institution, where they have access to institutional resources such as auditoriums or videoconference rooms to organize and host academic activities like conferences, schools and meetings. Resources also include a great analytical and instrumental capability for developing new research and technology.

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Resources

- SOMA is presently working on obtaining funding from CONACyT with the purpose of:
  - Supporting the organization of the Mexican School of Astrobiology, the Biannual Meeting of SOMA and the Latin American School of Astrobiology.
  - Supporting the participation of Mexican students and early-career scientists in international academic activities.
  - Supporting the creation of EPO materials and Virtual Field Trips.

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Long-term activities: Research

- Strengthening and promoting the collaboration between NAI researchers and scientists working on Mexican academic institutions by supporting a program of continuous visits of NAI researchers for working in specific projects and regular academic activities.
- Developing resources for a program of regular field trips to sites located in Mexico relevant to Astrobiology.

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Long-term activities: Formation of human resources

- Establishing programs for graduate students and early career scientists to do internships in NAI teams and Mexican academic institutions.
- Collaborating with NAI for the establishment of a formal graduate training in Astrobiology in Mexican academic institutions.

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Long-term activities: Education and Public Outreach

- Creating Virtual Field Trips for Mexican sites relevant to Astrobiology.
- Translating into Spanish EPO materials created by the NAI to be used in Spanish speaking countries and by Spanish speaking minorities in the United States.
- Collaborating with the NAI for promoting EPO materials among different publics using electronic media.

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Relevant sites for Astrobiology in Mexico




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SOMA appreciates your kind attention!!!